**( v ) Preliminary Specifications**
**( ) Final Specifications**

| | |
|---|---|
| **Module** | 22.9 Inch Monitor |
| **Model Name** | G229HAF01.0 |

| **Customer** | **Date** | **Approved by** | **Date** |
|---|---|---|---|
| | | Crystal Hsieh | 2019. 01. 15 |
| **Checked & Approved by** | **Date** | **Prepared by** | **Date** |
| | | HsinYin Lee | 2019. 01. 15 |
| Customer's sign back page | | General Display Business Division / AU Optronics corporation | |

# Contents

## Record of Revision

| Version | Date (yyyy/m/d) | Page | Old description | New Description |
|---|---|---|---|---|
| 0.1 | 2019/01/15 | All | | first edition |
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# 1. Operating Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the monitor surface is soiled, wipe it with absorbent cotton or other soft cloth.
5) Since the monitor is made of glass, it may break or crack if dropped or bumped on hard surface.
6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
7) Do not open or modify the monitor Assembly.
8) In case if a monitor has to be put back into the packing container slot after it was taken out from the container, do not press the center of LED light bar edge. Instead, press at the far ends of the LED light bar edge softly. Otherwise the monitor may be damaged.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
10) After installation of the monitor into an enclosure, do not twist nor bend the monitor even momentarily. While designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the monitor from outside. Otherwise the monitor may be damaged.
11) Small amount of materials having no flammability grade is used in the monitor. The monitor should be supplied by power complied with requirements of Limited Power Source (IEC60950-1 or UL60950-1), or be applied exemption.
12) Micro USB only support read Image/Video files, don’t connector 5V of USB from another host like PC ,mobile phone

## 2. General Description

This specification applies to the 22.9 inch wide color a-Si TFT-LCD monitor G229HAF01.0. The screen format is intended to support the resolution 1920(H) x 165(V)) and 16.7M colors.

## 2.1 Display Characteristics

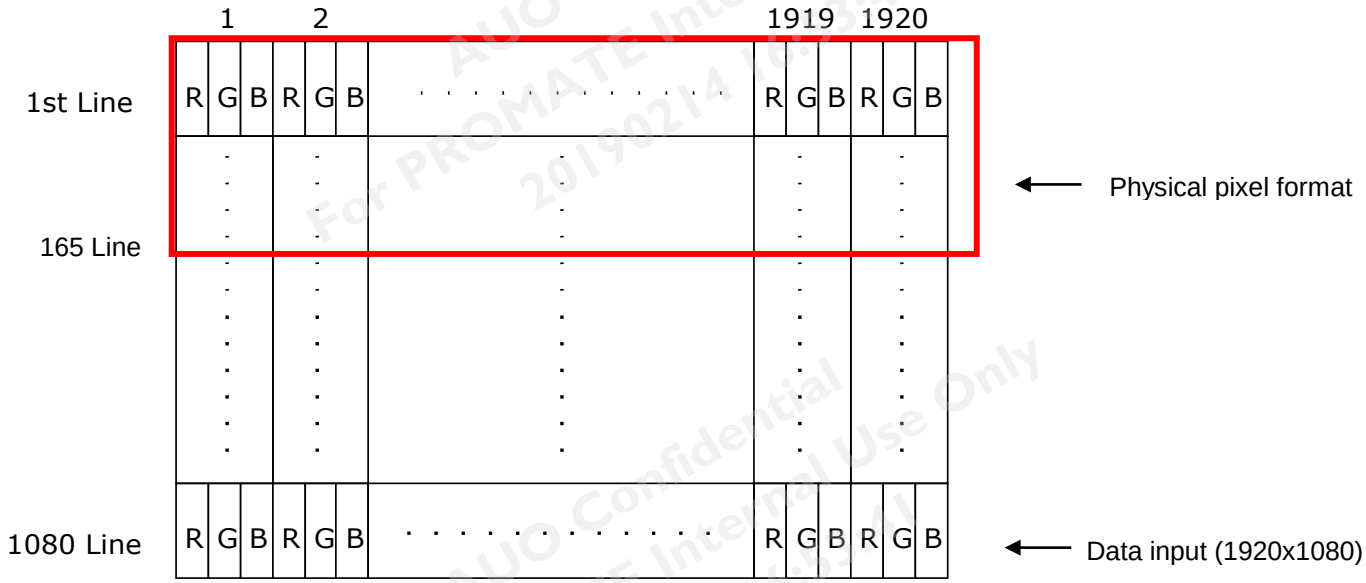
The following items are characteristics summary on the table under 25 °C condition:

| | | |
|---|---|---|
| Panel | Model | G229HAF01.0 |
| | LCD Size | 22.9 inch |
| | Light Source | LED |
| | Active Area | 578.88(H) x 49.7475(V) mm |
| | Resolution | 1920 x 165 (suggest),<br>1920*1080, *1 |
| | Aspect Ratio | 12:1 |
| | Brightness (typ.) | 700cd/m$^2$ |
| | Contrast Ratio (typ.) | 1000:1 |
| | Response Time | 25ms (Tr+Tf) |
| | Frame Rate | 60 Hz |
| | Viewing Angle | 89 / 89 / 89 / 89 degree |
| | Light Life | 50,000 hrs (min.) |
| | Panel Surface | Anti-Glare type, 3H, Haze 25% |
| | Color gamut | 72% NTSC |
| | Display Color | 8bit, 16.7M |
| Power | Power supply | AC 100V-240V, 50-60Hz, 0.98A (typ.) |
| | Power consumption | 12W (typ.) |
| Display | Signal input | Micro HDMI x 1 (support DDC/CI function), *2<br>Micro USB x 1 (Support Image/Video ), *3 |
| | Dimension (Lx W x D) | 587.08 x 62.05 x 16.5 mm |
| | Weight(Net) | 690g (typ.) |
| | Border width (U/D/R/L) | 3.4 / 8.9 / 4.1 / 4.1 mm |
| | Wall Mounting | M3 *4mm / Pitch 190mm |
| Environment | Operation Temp | 0°C ~50°C |
| | Storage Temp | -20°C ~ 60°C |
| | Operating Humidity | 5% ~ 80% RH |

| | | |
|---|---|---|
| | Storage Humidity | 5% ~ 80% RH |
| | Display Orientation | Landscape |
| Accessory | Power cable | 3 in 1 (US/JPN/TW) x1 |
| | Adaptor | 12V, 3A x 1 |

* Note1 : Resolution

Following figure shows the relationship of the input signals and LCD pixel format. This panel resolution is 1920x165, and for another support input 1920x1080 format signal to it. And the data after line 165 (inlculde 165) All should be set to “black” command.




*Note2 : DDC/CI command

| Destination Address | Source Address | Length | Set VCP Feature Command | VCP Opcode | High Byte | Low Byte | Checksum | Stop Bit | Range | Technology |
|---|---|---|---|---|---|---|---|---|---|---|
| 6E | 51 | 84 | 03 | 10 | 00 | 00~64 | A8~CC | P | 0~100 | Backlight |
| | | | | 14 | 00 | 0C | A0 | P | | BL enable |
| | | | | | 00 | 0D | A1 | P | | BL disable |
| | | | | 60 | 00 | 04 | DC | P | | Play by USB |
| | | | | | 00 | 09 | D1 | P | | F/W update |

*Note3 : USB function

| | Support | Solution |
|---|---|---|
| **Image** | JPEG (Baseline) | 1920 x 165 (suggest), 1920*1080, *1 |
| | BMP(TBD) | |
| **Video** | MPEG4(TBD) | |
| | H.264 | |

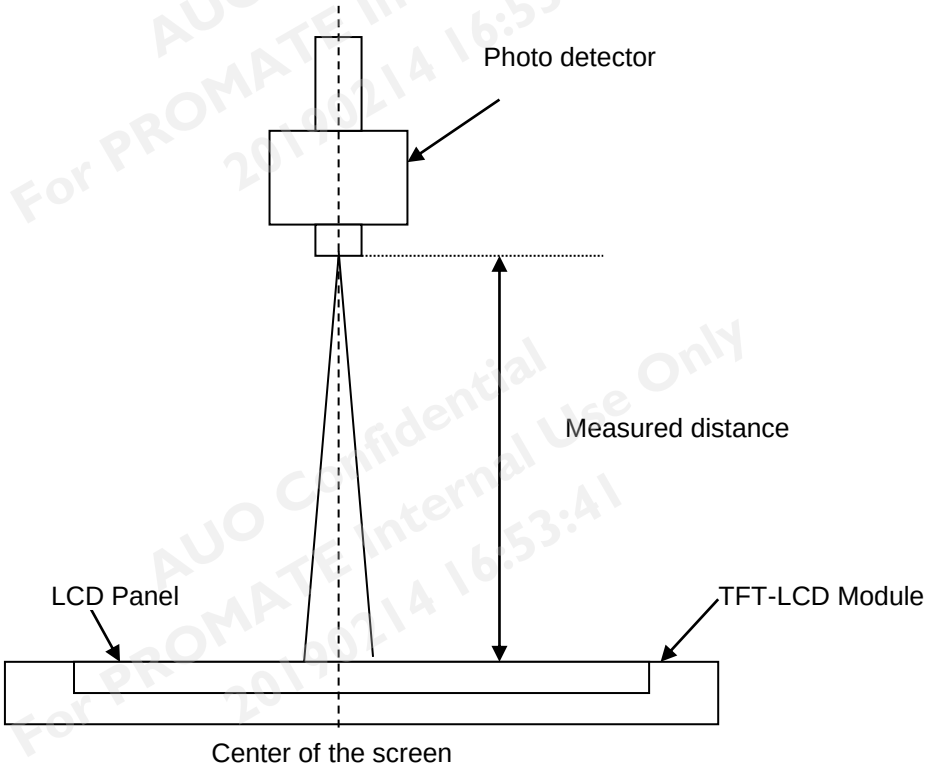
## 2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25 °C:

| Item | Unit | Conditions | Min. | Typ. | Max. | Note |
|---|---|---|---|---|---|---|
| Viewing Angle | [degree] | Horizontal (Right)<br>CR >10 (Left) | -<br>- | 89<br>89 | -<br>- | ***2*** |
| | | Vertical (Up)<br>CR > 10 (Down) | -<br>- | 89<br>89 | -<br>- | |
| Contrast ratio | | Normal Direction | 800 | 1000 | - | ***3*** |
| Response Time | [msec] | Raising Time ($T_{rR}$) | - | 13 | - | ***4*** |
| | | Falling Time ($T_{rF}$) | - | 12 | - | |
| | | Raising + Falling | - | 25 | - | |
| Color / Chromaticity Coordinates (CIE1931) | - | Red x | TBD | TBD | TBD | ***5*** |
| | | Red y | TBD | TBD | TBD | |
| | | Green x | TBD | TBD | TBD | |
| | | Green y | TBD | TBD | TBD | |
| | | Blue x | TBD | TBD | TBD | |
| | | Blue y | TBD | TBD | TBD | |
| | | White x | TBD | TBD | TBD | |
| | | White y | TBD | TBD | TBD | |
| Central Luminance | [cd/m$^2$] | | 560 | 700 | - | ***6*** |
| Luminance Uniformity | [%] | | 70 | 75 | - | ***7*** |
| Color Gamut | % | | - | 72 | - | |

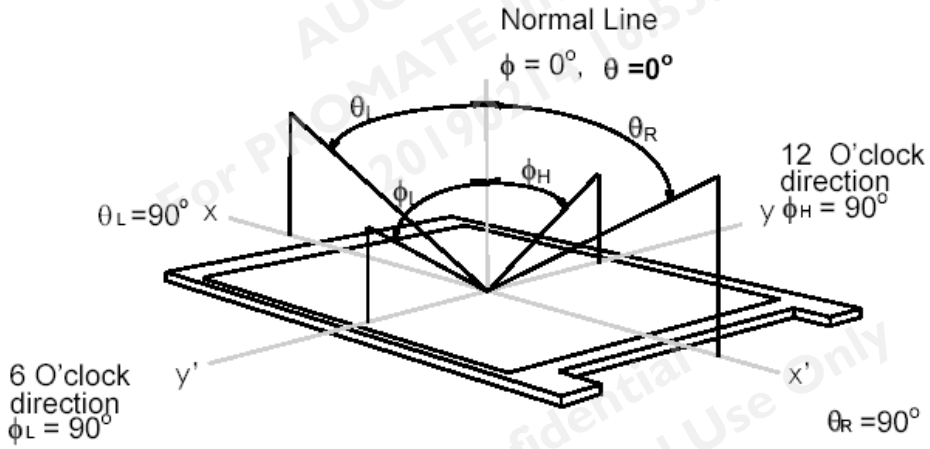
***Note 1:* Measurement method**

The monitor should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring (at surface 35oC). In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.




***Note 2:* Definition of viewing angle** measured by ELDIM (EZContrast 88)

Viewing angle is the measurement of contrast ratio ≧10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.

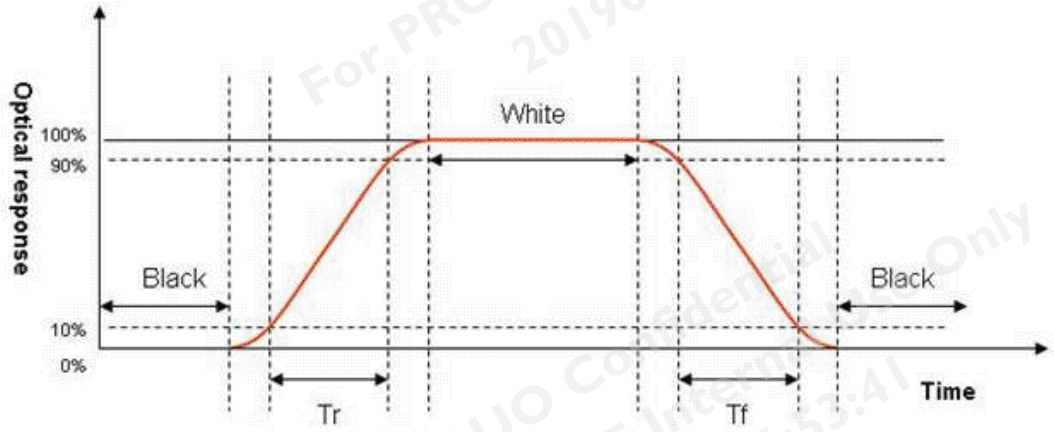



***Note 3:* Contrast ratio** is measured by TOPCON SR-3

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the “White” state}}{\text{Brightness on the “Black” state}}$$

***Note 4:*** **Definition of Response time** measured by Westar TRD-100A

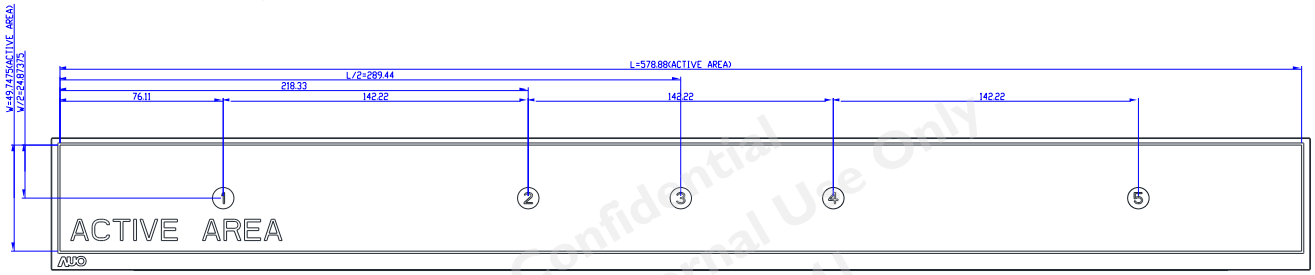
The output signals of photo detector are measured when the input signals are changed from “White” to “Black” (falling time) and from “Black” to “White” (rising time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.




***Note 5:*** **Color chromaticity and coordinates (CIE) is** measured by TOPCON SR-3

***Note 6*****: Central luminance is** measured by TOPCON SR-3

***Note 7:*** **Luminance uniformity of these 5 points is defined as below and** measured by TOPCON SR-3




$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1-5)}}{\text{Maximum Luminance in 9 Points (1-5)}}$$

# 3. Absolute Maximum Ratings

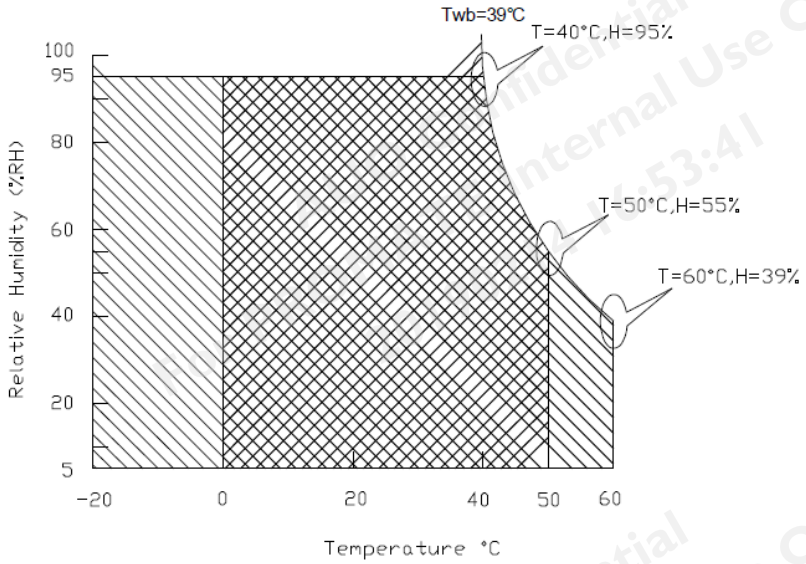
## 3.1 Absolute Ratings of Monitor

| Item | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| Logic/LCD Drive Voltage | VDD | -0.3 | 16 | [Volt] | |
| Logic/LCD Drive Voltage | VHDMI | -0.3 | 7 | [Volt] | |
| Micro USB | VBUS1 | -0.3 | 7 | [Volt] | |

## 3.2 Absolute Ratings of Environment

| Item | Symbol | Min. | Max. | Unit | Conditions |
|---|---|---|---|---|---|
| Operating Temperature | TOP | 0 | 50 | [ºC] | ***Note 3 & 4*** |
| Operation Humidity | HOP | 5 | 80 | [%RH] | |
| Storage Temperature | TST | -20 | 60 | [ºC] | |
| Storage Humidity | HST | 5 | 80 | [%RH] | |

***Note 1:*** With in Ta (25 ºC)
***Note 2:*** Permanent damage to the device may occur if exceeding maximum values
***Note 3:*** For quality perfermance, please refer to AUO IIS(Incoming Inspection Standard).
***Note 4***: Operation Temperature +60°C is defined as panel surface termperature.




Operating Range Storage Range +

# 4. Electrical Characteristics

## 4.1 Set Module

### 4.1.1 Power Specification

Input power specifications are as follows:

| Symbol | Parameter | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| VDD | Logic/LCD Drive Voltage | 10 | 12 | 13.2 | [Volt] | +/-10% |
| IDD | Input Current | - | TBD | TBD | [A] | VDD= 12V, All White Pattern At 60Hz, |
| PDD | VDD Power | - | TBD | TBD | [Watt] | VDD=12V, All White Pattern At 60Hz |
| IRush | Inrush Current | - | - | TBD | [A] | Note 1 |
| VDDrp | Allowable Logic/LCD Drive Ripple Voltage | - | - | 300 | [mV] p-p | VDD= 12V, All White Pattern At 60Hz |

Note 1 : Turn On delay time less than 10 seconds at input voltage is 100-240Vac

HDMI Port +5V output power specifications are as follows:

| Symbol | Parameter | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| VHDMI | Logic/Drive Voltage | 4.75 | 5 | 5.25 | [Volt] | +/-5% |
| IHDMI | Output Current | - | - | TBD | [A] | HDMI Mode, All White Pattern At 60Hz, |
| PVHDMI | HDMI Power | - | - | TBD | [Watt] | HDMI Mode, All White Pattern At 60Hz |
| IRush | Inrush Current | - | - | 0.6 | [A] | |
| VHDMIrp | Allowable Logic/Drive Ripple Voltage | - | - | 300 | [mV] p-p | Data link with a HDMI Monitor |

USB Port +5V output power specifications are as follows:

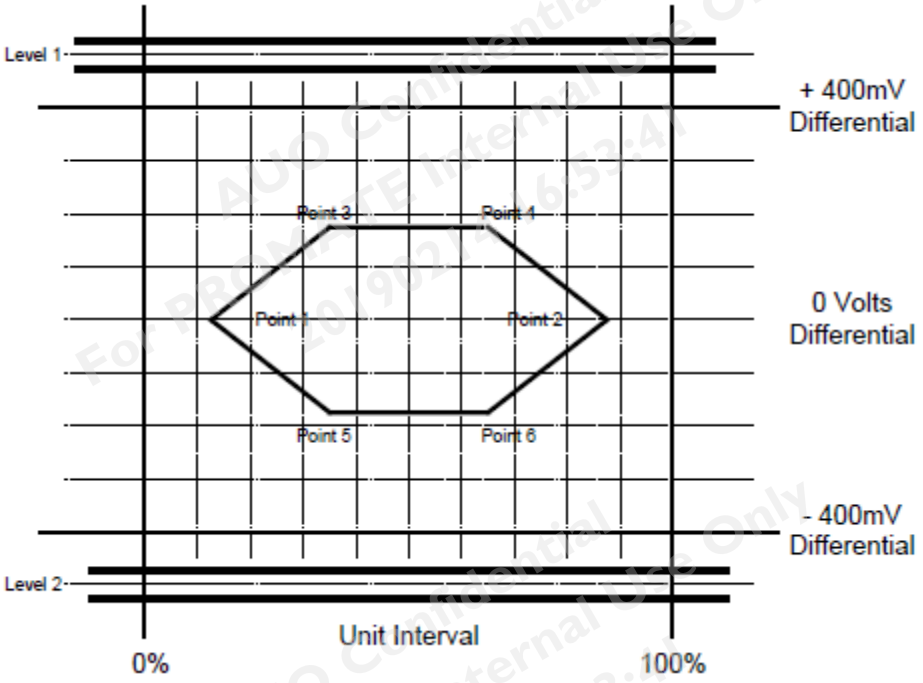
| Symbol | Parameter | Min | Typ | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| VBUS1 | Logic/Drive Voltage | 4.75 | 5 | 5.25 | [Volt] | +/-5% |
| IBUS1 | Output Current | - | TBD | TBD | [A] | Connected with a USB Device |
| PVBUS1 | USB Power | - | | TBD | [Watt] | Connected with a USB Device |
| IRush | Inrush Current | - | - | 4 | [A] | |
| VBUS1rp | Allowable Logic/Drive Ripple Voltage | - | - | 300 | [mV] p-p | Data link with a USB Device |

### 4.1.2 Signal Electrical Characteristics

Characteristics of USB Port are as follows :

| Symbol | Parameter | Min | Typ | Max | Units | Condition |
|---|---|---|---|---|---|---|
| VTH | Differential Input High Threshold | - | | +525 | mV | VICM = 1.6V<br>***Note 1*** |
| VTL | Differential Input Low Threshold | -525 | | - | mV | VICM = 1.6V<br>***Note 1*** |
| \|VID\| | Input Differential Voltage | 175 | - | 525 | mV | ***Note 1*** |
| VICM | Differential Input Common Mode Voltage | | 1.6 | | V | VTH-VTL = 1.05V (max)<br>***Note 1*** |

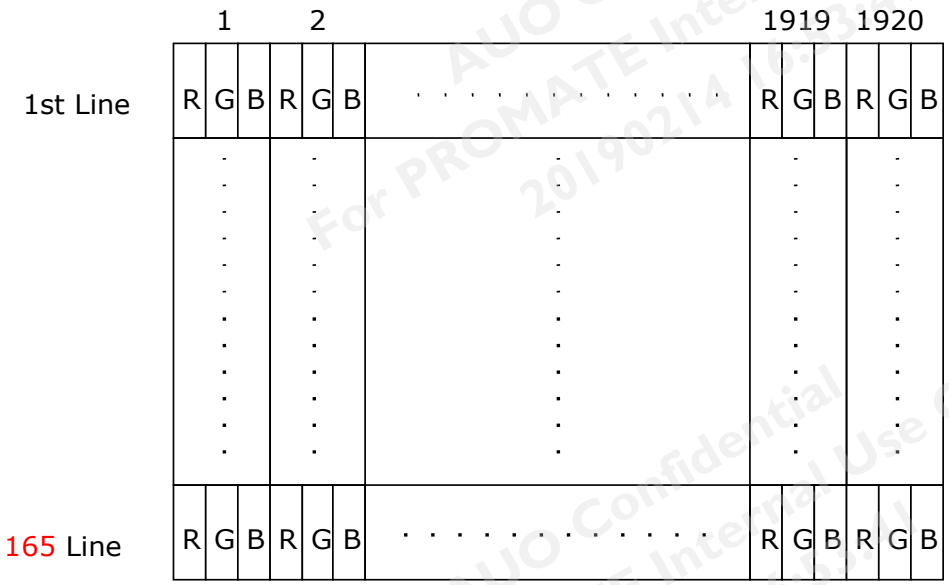
***Note 1:*** USB Port, Transmit Waveform Requirement.



# 5. Signal Characteristic

## 5.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.



## 5.2 Signal Description

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

### 5.2.1 Micro USB Connector

| Connector Name / Designation | Interface Connector / Interface card |
|---|---|
| Manufacturer | Hirose Electric Co Ltd |
| Type Part Number | ZX62D-AB-5P8(30) |
| Mating Housing Part Number | TBD |

The USB Port are support both Micro A and Micro B Connector.

**Pin Assignment**

| Pin# | Signal Name |
|---|---|
| 1 | +5V |
| 2 | Data- |
| 3 | Data+ |
| 4 | ID |
| 5 | GND |

*Note1:* Start from right side

### 5.2.2 Micro HDMI Connector

| Connector Name / Designation | Micro HDMI Connector |
|---|---|
| Manufacturer | TBD |
| Connector Model Number | TBD |
| Mating Connector Model Number | TBD |

**Pin Assignment**

| Pin# | Symbol | Signal Name |
|---|---|---|
| 1 | HOT Plug Detect | HOT Plug Detect |
| 2 | Utility | NC |
| 3 | TMDS Data2+ | Positive HDMI differential data input (2) |
| 4 | TMDS Data2 Shield | Power Ground |
| 5 | TMDS Data2- | Negative HDMI differential data input (2) |
| 6 | TMDS Data1+ | Positive HDMI differential data input (1) |
| 7 | TMDS Data1 Shield | Power Ground |
| 8 | TMDS Data1- | Negative HDMI differential data input (1) |
| 9 | TMDS Data0+ | Positive HDMI differential data input (0) |
| 10 | TMDS Data0 Shield | Power Ground |
| 11 | TMDS Data0- | Negative HDMI differential data input (0) |
| 12 | TMDS Clock+ | Positive HDMI clock input (0) |
| 13 | TMDS Clock Shield | Power Ground |
| 14 | TMDS Clock- | Negative HDMI clock input (0) |
| 15 | CEC | CEC |
| 16 | DDC/CEC Ground | Power Ground |
| 17 | SCL | No contact (For AUO internal use) |
| 18 | SDA | No contact (For AUO internal use) |

## 5.2.3 Type C Connector

**Power Input**

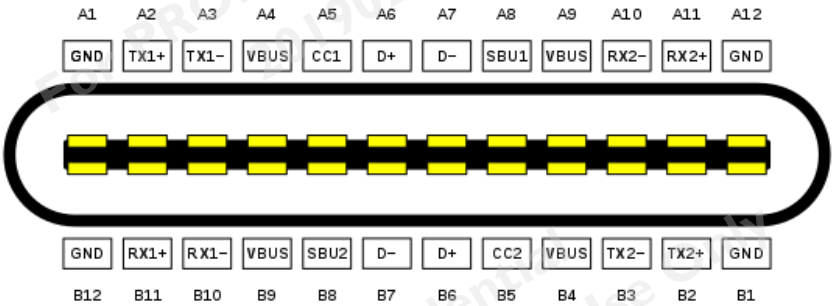
| Connector Name / Designation | Connector |
|---|---|
| Manufacturer | Take Wing Technology CO. Ltd |
| Connector Model Number | UCF008-A2130000-AS |
| Mating Connector Model Number | TBD |

**Power output**

| Connector Name / Designation | Connector |
|---|---|
| Manufacturer | Hirose |
| Connector Model Number | CX90B1-24P |
| Mating Connector Model Number | TBD |

**Pin Assignment**

| Pin# | Symbol | Signal Name |
|---|---|---|
| A1 | GND | Ground |
| A12 | GND | Ground |
| B1 | GND | Ground |
| B12 | GND | Ground |
| Other | Other | None |
| Other | Other | None |
| A4 | VBUS | 12V |
| A9 | VBUS | 12V |
| B4 | VBUS | 12V |
| B9 | VBUS | 12V |



## 5.3 LCM Timing Characteristics

| Parameter | | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Frame Rate | | - | - | 60 | - | Hz |
| Clock frequency | | 1/ $T_{Clock}$ | - | 40 | - | MHz |
| Vertical Section | Period | $T_V$ | - | 195 | - | $T_{Line}$ |
| | Active | $T_{VD}$ | 165 | | | |
| | Blanking | $T_{VB}$ | - | 30 | - | |
| Horizontal Section | Period | $T_H$ | - | 3420 | - | $T_{Clock}$ |
| | Active | $T_{HD}$ | 1920 | | | |
| | Blanking | $T_{HB}$ | - | 1500 | - | |

## 6. Reliability Test Criteria

Environment test conditions are listed as following table.

| Items | Required Condition | Note |
|---|---|---|
| Temperature Humidity Bias (THB) | Ta= 50ºC, 80%RH, 300hours | |
| High Temperature Operation (HTO) | Ta= 50ºC, 300hours | ***3*** |
| Low Temperature Operation (LTO) | Ta= 0ºC, 300hours | |
| High Temperature Storage (HTS) | Ta= 60ºC, 300hours | |
| Low Temperature Storage (LTS) | Ta= -20ºC, 300hours | |
| Vibration Test<br>(Non-operation) | Acceleration: 1.5 G<br>Wave: Random<br>Frequency: 10 - 200 Hz<br>Sweep: 30 Minutes each Axis (X, Y, Z) | |
| Shock Test<br>(Non-operation) | Acceleration: 50 G<br>Wave: Half-sine<br>Active Time: 20 ms<br>Direction: ±X, ±Y, ±Z (one time for each Axis) | |
| Drop Test | Height: 60 cm, package test | |
| Thermal Shock Test (TST) | -20ºC /30min, 60ºC /30min, 100 cycles | ***1*** |
| On/Off Test | On/10sec, Off/10sec, 30,000 cycles | |
| ESD (Electro Static Discharge) | Contact Discharge: ± 8KV, 150pF(330Ω ) 1sec, 25 times/ point. | ***2*** |
| | Air Discharge: ± 15KV, 150pF(330Ω ) 1sec 25 times/ point. | |

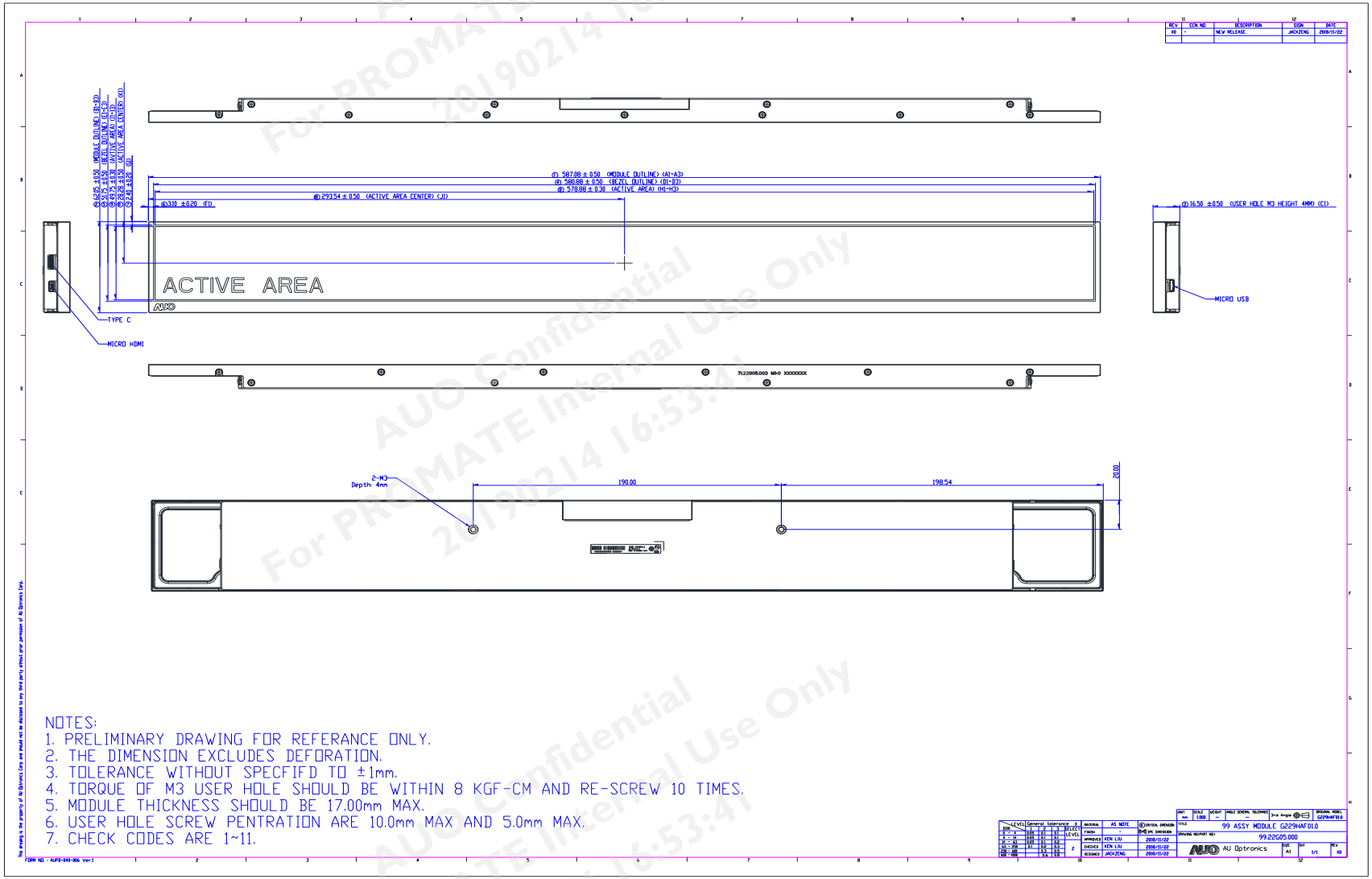
*Note 1*: The TFT-LCD module set will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20ºC to 60ºC, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

*Note 2*: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

*Note 3:* No function occurs Mura shall be ignored after high temperature reliability test.

# 7. Mechanical Characteristics

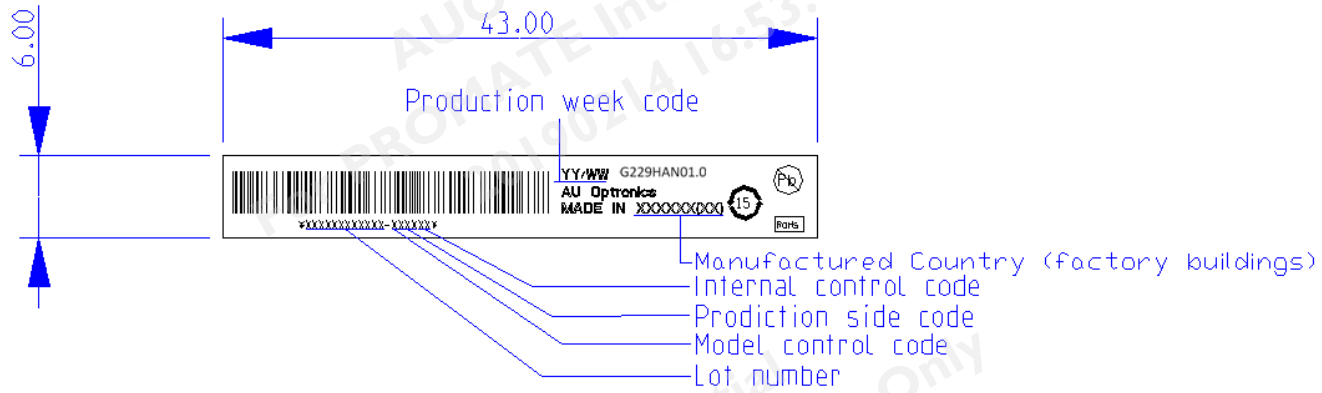
## 7.1 Monitor Outline Dimension



# 8. Label and Packaging

## 8.1 Shipping Label

Unit: mm



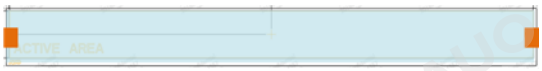

*Note 1:* For Pb Free products, AUO will add for identification.

*Note 2:* For RoHS compatible products, AUO will add for identification.

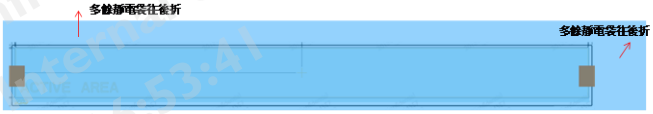
*Note 3:* For China RoHS compatible products, AUO will add for identification.

*Note 4:* The Green Mark will be presented only when the green documents have been ready by AUO Internal Green Team.

## 8.2 Carton Package



1. Put a protective film on the panel and fix it with masking tape




2. Panel into the electrostatic bag and Fold the remaining electrostatic bag back

3. Put first layer of EPE

4. Put panel in the middle of EPE, Visible area facing up,and accessories put into the side groove.

4-1. Accessory placement method

5. Finish the first layer and put it in the second layer

6. Finish the second layer and put it in the third layer.

7. Cover with EPE cushion.

8. Sealing the carton with packing tape

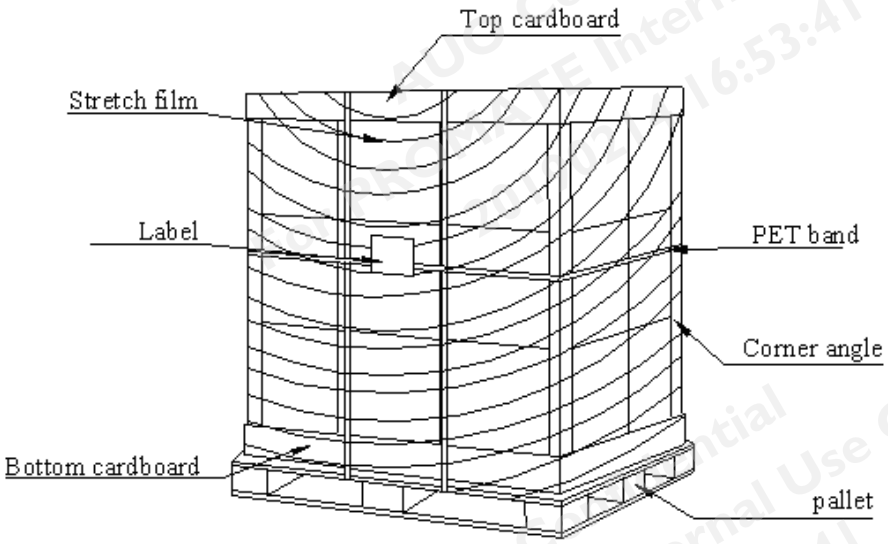
**Palletizing sequence**

The operation of taking shape and related information of full carton:
Max capacity：6 monitors per carton
Max weight: 9~10kg per carton (TBD)
Outside dimension of carton: 730mm(L)* 310mm(W)* 285mm(H)
Pallet size： 980mm * 740 mm * 132mm(M25)

**Box stacked**

Module by air：(1 *3) *4 layers，one pallet put 12 boxes，total 72 pcs monitors
Module by sea：One pallet (1 *3) *4 layers + One pallet (1 *3) *2 layers，total 108 pcs monitors
Module by sea_ HQ :(1 *3) *4 layers + One pallet (1 *3) *3 layers Total 126 pcs monitors

## 8.3 Shipping Package of Palletizing Sequence




| Item | | Specification | | |
|---|---|---|---|---|
| | | Q'ty | Dimension | Weight (Kg) |
| 1 | Packing Box | 6 pcs/Box | 73(L)cm x 31(W)cm x 28.5(H)cm | 9~10(TBD) |
| 2 | Pallet | 1 | 98(L)cm x 74 (W)cm x 13.2(H)cm | 12.4 |
| 3 | Pallet after Packing | 12boxes/pallet | 98(L)cm x 74(W) cm x 127.2(H) cm | 108~120(TBD) |

# 9 Safety

## 9.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

## 9.2 Materials

### 9.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible AUO toxicologist.

### 9.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

## 9.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

## 9.4 National Test Lab Requirement

The display module will satisfy all requirements for compliance to:

| | |
|---|---|
| UL 60950-1 second edition | U.S.A. Information Technology Equipment |